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Emergency Language Services in Low-Resource Language Regions: Practices and Insights from Yunnan Province

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Abstract

Low-resource language regions are critical areas in building China's national emergency language service system. This study reviews the domestic progress in emergency language services for low-resource areas and regards geological rescue operations in Yunnan Province as a case study. By analyzing Yunnan's linguistic ecology and disaster risk profile, the paper reveals the key technological breakthroughs achieved in multilingual emergency response. On this basis, it proposes three insights for sustainable development: (1) a dual-track model integrating technology and human resources, (2) the construction of an emergency language service platform, and (3) sustainable financing mechanisms supported by public funds and multilateral cooperation. The study aims to clarify the urgent needs of low-resource language regions and to provide references for strengthening China's national emergency language service infrastructure.

Keywords

Low-resource Language; Emergency Language Services; Geological Rescue.

1. Overview of Emergency Language Services in Low-Resource Language Regions

With the increasing severity of global climate change and tectonic events, the importance of emergency language services has become increasingly apparent. In China, many ethnic minority regions and border areas are categorized into low-resource language areas. The concept of "low-resource language," first introduced by Dutch linguist S. Krauwer and later refined by scholars such as Vincent et al., refers to languages that lack standardized writing systems, professional linguists or translators, sufficient digital resources, and adequate internet coverage [1].

China has been optimizing its national emergency language service system through top-level policy design, digital resource construction, and multi-level talent training. Regarding policies, the Opinions on Comprehensively Strengthening Language and Script Work in the New Era (General Office of the State Council, 2020) emphasized the need to "establish a national language service mechanism, build volunteer teams, and enhance emergency language services" [2]. In addition, the National Overall Emergency Response Plan for Public Emergencies (February 2025) required communication, cybersecurity, and linguistic departments to improve their specialized emergency capabilities.

In practice, following the successful pilot of emergency language services in Zhangjiajie, multiple regions have implemented integrated platforms, 24-hour hotlines, and professional interpreter databases to enhance disaster response efficiency. Real-time speech translation

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systems based on deep neural networks have been developed to serve low-resource regions, which enables simultaneous interpreting across multiple minority languages. Currently, the integration of edge-AI and cloud platforms supports real-time language services even in low-bandwidth environments, providing reliable communication support for rescue operations in remote ethnic areas and cross-border regions.

2. Practice of Emergency Language Services in Yunnan Province

2.1. Yunnan's Linguistic Ecology and Geological Disaster Risk

Yunnan Province, characterized by complex topography and active geological structures, faces frequent landslides, debris flows, and flash floods, especially in the mountainous and hilly zones of central and southern Yunnan. High-risk areas include Pu'er, Lincang, Wenshan, Xishuangbanna, southwestern Yuxi, southern Honghe, Nujiang, Zhaotong, Baoshan, and Dehong.

These regions are home to different ethnic communities:

In Pu'er, there are Dai, Wa, Yi, Hani, Lahu, and Blang people. They speak Dai, Wa, Yi, Hani, Lahu, and Blang languages. Lincang is home to Wa, Dai, Yi, Lahu, Blang, and De'ang ethnic groups, each with their own languages Wenshan is mainly Zhuang. Also, Yi and Miao languages are spoken there. Xishuangbanna is mostly populated by Dai people (Lü dialect), and Hani and Lahu languages are also used. In southwestern Yuxi, Yi and Hani are the main ethnic groups. Nujiang is mainly populated by Lisu, Nu, and Dulong people, and Lisu is the main language. Zhaotong, Baoshan, and Dehong mainly have Yi, Dai, and Jingpo communities.

It is evident that Yunnan's high-risk geological zones largely overlap with ethnic minority settlements. The dominant local languages-Dai, Wa, Yi, Hani, Lahu, Zhuang, Lisu, and Jingpo-represent typical low-resource languages with limited written materials and digital corpora. Consequently, geological rescue in these areas requires multilingual communication and culturally sensitive language strategies.

2.2. Technological Breakthroughs in Yunnan's Emergency Language Rescue

Yunnan's multilingual emergency language response has achieved multiple technological breakthroughs, forming a complete "data-model-platform-terminal" ecosystem.

First, field linguistic data was collected at the county and township levels. The goal was to create initial audio, text, and bilingual aligned corpora for Dai, Wa, Yi, Hani, and Lahu languages [3][4]. This changed the situation from having no data to having data that could be used for training.

Second, an end - to - end multilingual speech translation model based on deep neural networks was developed. Through cross - lingual transfer learning and self - supervised pre - training, field experiments in low - bandwidth conditions got an average latency of about 5 seconds and accuracy rates between 85% and 90%.

Third, lightweight Transformer models (like Mobile - BERT, Tiny - Transformer) were put on mobile terminals such as smartphones and drones for offline speech recognition and preliminary translation. After that, the results were synced with the cloud to improve quality. This made sure the service can keep going in low - bandwidth environments.

Finally, a unified emergency language service platform was set up. It combines a multilingual terminology database, a 24-hour hotline, an interpreter scheduling system, and a real - time visual disaster map. This system can automatically match language demands and route them. As a result, it greatly improves cross-lingual response speed and information accuracy. These new technologies have provided reliable language support not only for Yunnan but also for other ethnic minority regions in China.

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3. Insights for Emergency Language Services in Low-Resource Regions

3.1. Dual Development of Technology and Human Resources

The availability and competence of professional interpreters remain critical constraints in emergency response. China's pool of high-level translators, particularly in non-universal or minority languages, is still limited [5]. Consequently, many low-resource language areas lack trained interpreters capable of handling specialized, terminology-dense emergency communication.

To address this gap, a dual-track approach is necessary: this method combines building up human ability and improving technology.

In curriculum design, higher education institutions can develop integrated programs that mix "foreign language plus field practice plus specialization" [6]. This kind of cross-discipline training should cover knowledge in medicine, psychology, linguistics, and emergency management. Simulation drills and case workshops can help trainees master systematic emergency translation. Regular field exercises with volunteer teams can test how ready they are in both language skills and technical skills. Universities should also establish dedicated language technology laboratories to support low-resource corpus construction and provide infrastructure for collaborative research.

3.2. Construction of a Multilayered Language Service Platform

Low-resource languages typically suffer from minimal annotated data, scattered distribution, and extremely small-scale corpora. Publicly available audio resources are scarce, and many languages contain only thousands of annotated sentences, compared with millions in high-resource languages. This data scarcity severely hinders the development of neural machine translation (NMT) systems.

Even the linguistic resources that are annotated by hand are still small. And they often only cover morphological or syntactic annotations. As noted in LowResourceEval 2019, languages like Evenki, Selkup, and Veps-Karelian only have a few CONLL-U corpora made by linguists. This shows that the lack of data is still a big issue [7].

When building a multilayered emergency language service system, it's significant to make sure this system has core functions like "rapid interpreting, public information dissemination, and public-opinion monitoring."

Advanced techniques can help solve the data shortage problem well, and they can also upgrade translation quality and speed. These techniques include self-supervised pre-training, machine-translation-plus-post-editing (MT-PE), and multi-modal data integration [8].

A systematic data-collection mechanism should include dialectal, spoken, written, and sign-language materials, continuously updating the low-resource corpus. Additionally, a "language volunteer pool" can be established via digital platforms to recruit bilingual speakers from target communities as standby emergency translators. Multi-level quality-control workflows must ensure the accuracy and consistency of emergency language outputs.

3.3. Sustainable Financing Mechanisms

In international and domestic disaster relief, low-resource language regions often involve multiple linguistic communities. When emergency messages are delivered without cultural adaptation, misunderstandings and mistrust can arise, undermining rescue efficiency. Furthermore, post-disaster psychological counseling requires culturally appropriate communication; overly literal or mechanical translations may trigger cultural conflicts or emotional resistance. Existing machine translation systems also struggle with metaphorical and culture-laden expressions due to insufficient training data.

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To ensure the long-term sustainability of emergency language services, a multi-layered financing framework is essential.

China can set up special funds in disaster-prone areas and border regions. These funds can gather money from the government, companies, and social groups. The money can be used for corpus development, platform construction, and talent training. For example, a Cultural Adaptation Fund can support local linguists to annotate culture-specific expressions, metaphors, and rituals. This way, we can form corpora that fit local culture. A Talent Development Fund can provide money for short-term multilingual interpreter programs. These programs can train professionals who can deliver culturally sensitive communication in emergencies.

Internationally, the UNHCR Language Service Unit provides a good model. It combines policy design, interpretation, and translation systems, and training programs. Together, these parts provide multilingual support for refugees and form a closed loop of "policy-planning-service."

By adopting similar mechanisms, China can systematically address core challenges such as cultural adaptation, technological platform maintenance, interpreter shortages, and the absence of standardized practices, thereby ensuring the long-term resilience of emergency language services in low-resource regions.

4. Conclusion

Combining the practice of geological rescue in Yunnan, this study identifies the core dilemmas faced by emergency language services in low-resource language regions: insufficient language resources, shortage of professional talents, and inadequate technological adaptability. Moreover, the overlap between high-disaster-risk areas and ethnic minority settlements further exacerbates communication barriers.

The study confirms that the "data-model-platform-terminal" technological ecosystem can break through the bottlenecks of multilingual communication in low-bandwidth environments. The dual development of technology and human resources, the establishment of multi-level platforms, and sustainable financing mechanisms are key solutions. In the future, it is necessary to deepen the integration of technology implementation and talent cultivation, improve culturally adaptive services, strengthen the resilience of China's national emergency language service system, and enhance disaster prevention and rescue efficiency.

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